

Appl. No. 10/602,912
Reply to Office Action of April 14, 2005

IN THE CLAIMS

1. (Original) A diagnostic apparatus suitable for use in an automobile controller comprising:

a power supply terminal conducting a reference voltage;

a sampling circuit coupled to said power supply terminal and having an output terminal for providing sampled values of said reference voltage; and

a reference voltage diagnostic circuit having an input terminal coupled to said output terminal of said sampling circuit, wherein said reference voltage diagnostic circuit maintains a historical value of said reference voltage over a predetermined time period, compares a current sampled value of said reference voltage to said historical value, and indicates a fault in said reference voltage in response to said current sampled value being different from said historical value by more than a predetermined threshold.

2. (Original) The diagnostic apparatus of claim 1 wherein said sampling circuit comprises:

an attenuation circuit having an input terminal coupled to said power supply terminal for receiving said reference voltage, and an output terminal for providing a scaled reference voltage; and

an analog-to-digital converter having an input terminal coupled to said output terminal of said attenuation circuit, and an output terminal for providing said current sample of said reference voltage.

3. (Original) The diagnostic apparatus of claim 1 wherein said reference voltage diagnostic circuit indicates said fault by storing a diagnostic error code in a memory location.

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4. (Original) The diagnostic apparatus of claim 1 wherein said reference voltage diagnostic circuit comprises:

a central processing unit coupled to said output terminal of said sampling circuit; and
a memory coupled to said central processing unit for storing an application program having a reference voltage diagnostic associated therewith which selectively indicates said fault in said reference voltage.

5. (Original) The diagnostic apparatus of claim 1 wherein said reference voltage diagnostic circuit updates said historical value based on said current sampled value using a first order lag filter.

6. (Original) The diagnostic apparatus of claim 1 further comprising a power supply for providing said reference voltage to said power supply terminal.

7. (Original) The diagnostic apparatus of claim 1 wherein said reference voltage diagnostic circuit indicates said fault in said reference voltage in response to either said current sampled value being greater than said historical value by more than a first predetermined threshold or by said current sampled value being less than said historical value by more than a second predetermined threshold.

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8. (Currently Amended) A diagnostic apparatus suitable for use in an automobile controller comprising:

first and second power supply terminals respectively conducting first and second reference voltages;

a digital sampling circuit coupled to said first and second power supply terminals and having an output terminal for providing sampled digital values of said first and second reference voltages; and

a reference voltage diagnostic circuit having an input terminal coupled to said output terminal of said sampling circuit, wherein said reference voltage diagnostic circuit compares a sampled value of said first reference voltage to a sampled value of said second reference voltage, and indicates a fault in at least one of said first and second reference voltages in response to a difference between said sampled value of said first reference voltage and said sampled value of said second reference voltage being greater than a predetermined threshold.

9. (Currently Amended) The diagnostic apparatus of claim 8 wherein said digital sampling circuit comprises:

a first attenuation circuit having an input terminal coupled to said first power supply terminal for receiving the first reference voltage, and an output terminal for providing a scaled first reference voltage;

a second attenuation circuit having an input terminal coupled to said second power supply terminal for receiving the second reference voltage, and an output terminal for providing a scaled second reference voltage; and

an analog-to-digital converter having a first input terminal coupled to said output terminal of said first attenuation circuit, having a second input terminal coupled to said output terminal of said second attenuation circuit, and an output terminal coupled to said input terminal of said reference voltage diagnostic circuit.

10. (Original) The diagnostic apparatus of claim 8 wherein said reference voltage diagnostic circuit indicates said fault by storing a diagnostic error code in a memory location.

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11. (Currently Amended) The diagnostic apparatus of claim 8 wherein said reference voltage diagnostic circuit comprises:

a central processing unit coupled to said output terminal of said digital sampling circuit;
and

a memory coupled to said central processing unit for storing an application program having a reference voltage diagnostic associated therewith which selectively indicates said fault in the first and second reference voltages.

12. (Previously Amended) The diagnostic apparatus of claim 8 further comprising first and second power supplies for providing said first and second reference voltages respectively to said first and second power supply terminals.

13. (Canceled)

14. (Currently Amended) ~~The method of claim 13~~ A method of diagnosing a fault of a reference voltage in a vehicle controller, comprising the steps of:

determining a current value of said reference voltage;

comparing said current value of said reference voltage to a historical value of said reference voltage; and

indicating a fault in said reference voltage if said current value is not within a predetermined threshold of the historical value;

wherein said step of determining said current value of said reference voltage comprises the steps of:

scaling said reference voltage to provide a scaled reference voltage; and

converting said scaled reference voltage to a digital signal in an analog-to-digital converter.

15. (Currently Amended) The method of claim ~~13~~ 14 further comprising the step of calculating said historical value using said current value.

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16. (Currently Amended) ~~The method of claim 15~~ A method of diagnosing a fault of a reference voltage in a vehicle controller, comprising the steps of:

determining a current value of said reference voltage;

calculating said historical value using said current value;

comparing said current value of said reference voltage to a historical value of said reference voltage; and

indicating a fault in said reference voltage if said current value is not within a predetermined threshold of the historical value;

wherein said step of calculating said historical value based on said current value comprises the step of calculating said historical value based on said current value using a first order lag filter.

17. (Currently Amended) ~~The method of claim 15~~ A method of diagnosing a fault of a reference voltage in a vehicle controller, comprising the steps of:

determining a current value of said reference voltage;

calculating said historical value using said current value;

comparing said current value of said reference voltage to a historical value of said reference voltage; and

indicating a fault in said reference voltage if said current value is not within a predetermined threshold of the historical value;

wherein said step of calculating said historical value based on said current value comprises the step of averaging all current values over a predetermined time period.

18. (Canceled)

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19. (Currently Amended) ~~The method of claim 18~~ A method of diagnosing a fault in one of multiple reference voltages in a vehicle controller, comprising the steps of:
determining values of first and second reference voltages;
calculating a difference between said first reference voltage and said second reference voltage;
comparing said difference to a predetermined threshold; and
indicating a fault in one of said first and second reference voltages if said difference is greater than said predetermined threshold;

wherein said step of determining said values of said first and second reference voltages comprises the steps of:

scaling said first reference voltage to provide a scaled first reference voltage;
scaling said second reference voltage to provide a scaled second reference voltage; and
converting said scaled first reference voltage and said scaled second reference voltage to corresponding digital signals in an analog-to-digital converter.

20. (Currently Amended) The method of claim ~~18~~ 19 wherein said step of indicating comprises the steps of:
determining a smaller one of said first and second reference voltages; and
setting an error flag corresponding to said smaller one of said first and second reference voltages.